NASA facts

DC-8 Airborne Science Laboratory

The DC-8 airborne science laboratory flies over the Dryden Aircraft Operations Facility, Palmdale, Calif.

NASA operates a highly modified Douglas DC-8 jetliner as a flying science laboratory. The aircraft, based at NASA's Dryden Aircraft Operations Facility in Palmdale, Calif., is used to collect data for experiments in support of projects serving the world's scientific community. Federal, state, academic and foreign investigators are among those who use NASA's DC-8.

Data gathered with the aircraft at flight altitude and by remote sensing have been used for studies in archaeology, ecology, geography, hydrology, meteorology, oceanography, volcanology, atmospheric chemistry, cryospheric science, soil science and biology.

Four types of missions are flown with the DC-8: sensor development, satellite sensor verification, space vehicle launch or re-entry telemetry data retrieval and optical tracking, and basic research studies of Earth's surface and atmosphere.

Sensor Development

Because it is flown in the Earth's atmosphere, the DC-8 offers a comparatively inexpensive way to test and verify prototype satellite instruments. Scientists use the DC-8 to develop ideas in instrument technology as well as to test new instruments and modify them if necessary based on flight results. Potential problems can be corrected before new instruments are launched into space. As a result, flight-proven hardware can lead to substantial savings in time and resources.

As an example, the DC-8 conducted the Active Sensing of CO_2 Emissions over Nights, Days and Seasons II campaign during the summer of 2011 supporting tests of four laser instruments used in gathering remote measurements of atmospheric carbon dioxide. Flights were flown over different land features from desert to snow to test surface reflectance effects on instrument performance. Space-borne lasers would find the same type of surfaces when used to study components of Earth's atmosphere from space. This research will contribute to further development of laser-based Earth-observing satellite instruments designed to measure atmospheric carbon dioxide.

Satellite Sensor Verification

Once in orbit, satellite instruments may send back billions of data bits daily. The DC-8 helps scientists answer questions about the accuracy of data obtained and how to interpret them. For these missions the DC-8 flies under a satellite's path, using instruments to compile the same information as that collected by the satellite. Through this process, algorithms used to interpret satellite data are evaluated and updated to reflect the results verified with DC-8 instrumentation.

Despite near-record levels of chemical ozone destruction in the Arctic in January and February 2005, observations from NASA's Aura satellite showed that other atmospheric processes restored ozone amounts to near average and stopped high levels of harmful ultraviolet radiation from reaching Earth's surface. Instruments flown on the DC-8 during NASA's Polar Aura Validation Experiment confirmed the satellite data. Ten instruments measured temperature, aerosols, ozone, nitric acid and other gases as the aircraft flew beneath Aura when it passed over the polar vortex.

Space Vehicle Launch/Re-entry Telemetry And Tracking

A tracking antenna used in receiving launch vehicle telemetry data was installed in the nose of the DC-8 allowing support of the launches of the Missile Defense Agency's Space Tracking and Surveillance Demonstration satellites and NASA's Glory Earth science satellite.

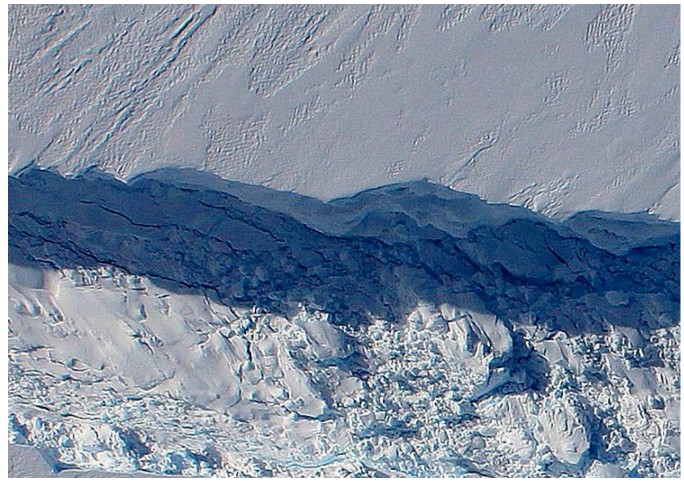
The DC-8 has also successfully supported optical tracking missions of spacecraft re-entering the Earth's atmosphere. Two examples are the re-entry of the European Automated Transfer Vehicle dubbed Jules Verne in 2008 and the 2010 Japan Aerospace Exploration Agency mission to track the re-entry of the Hayabusa spacecraft.

Basic Research Studies

In 1991, NASA launched a comprehensive program to study the Earth as an environmental system. The extended range, prolonged flight-duration capability, large payload capacity and laboratory environment of the DC-8 make it one of the premier research aircraft available to NASA's Science Mission Directorate. Combined with other aircraft, satellites or ground stations, the DC-8 complements and extends the range of an instrument package, allowing scientists to successfully address today's planetary issues.

The Convection and Moisture Experiment, or CAMEX, was a series of field research investigations intended to improve understanding and prediction of hurricane activity. The fourth campaign, during the summer of 2001, studied hurricane development, tracking, intensification and landfall. The DC-8 and a NASA ER-2 carried instruments that yielded information about hurricane structure, dynamics and motion. In 2010 the DC-8 joined a NASA Global Hawk in the Genesis and Rapid Intensification Processes campaign to again study hurricane growth and intensification.

In 2009 the DC-8 began participation in Operation IceBridge, NASA's annual polar ice field campaign, with flights over Antarctica from a deployment base at Punta Arenas, Chile. The aircraft carries researchers and their instruments over western and northern Antarctica in the largest airborne survey ever flown of Earth's polar ice. During March and April 2010, the DC-8 was based in Greenland for IceBridge's Arctic ice study. IceBridge's airborne research continues the multi-year measurements started by NASA's Ice, Cloud and Land Elevation Satellite (ICESat-I), which ceased operation in 2009, and will continue until ICESat-II is launched in 2016.



Researchers flying aboard NASA's DC-8 science laboratory were the first to discover this huge rift in Antarctica's Pine Island Glacier during Operation IceBridge in October 2011.

DC-8-72 Aircraft

The NASA DC-8-72 is a four-engine jet transport aircraft that has been highly modified to support the agency's Airborne Science mission. The aircraft, acquired in 1985, is 157 feet long with a 148-foot wingspan. With a range of 5,400 nautical miles (6,200 statute miles), it can fly at altitudes from 1,000 to 42,000 feet for up to 12 hours, although most science missions average six to 10 hours. The DC-8 can carry 30,000 pounds of scientific instruments and equipment and can seat up to 45 experimenters and flight crew.

The DC-8 incorporates a suite of sensors and data systems and provides services that can be tailored to specific missions or instruments. The DC-8 also has Iridium and Inmarsat satellite communications capability. Two Iridium-based communications systems, one for flight crew communications and one for science team communications, a multichannel system for upload of meteorological data, chat messaging, limited data telemetry and live Web page updates are available.

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